Multi-variable evaluation of a decadal convective permitting simulation

Erwan Brisson[1,2], Sajjad Saeed[2], Matthias Demuzere[2], Kwinten Van Weverberg[3], Annemarie Devis[2], Nicole van Lipzig[2]

[1] University of Frankfurt, Frankfurt am Main, Germany. [2] Katholieke Universiteit Leuven, Leuven , Belgium. [3] Université catholique de Louvain, Louvain-la-neuve, Belgium.

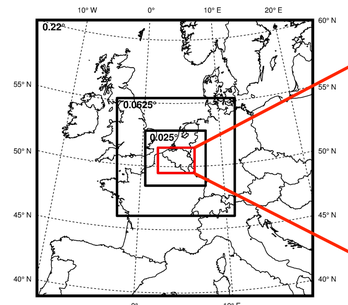
1. Introduction

- An 11-year simulation was performed at convective permitting scale (CPS) using the COSMO-CLM.
- These simulations show an improved representation of the precipitation daily cycle and the spatial patterns of temperature compared to non-CPS simulations.
- However, important biases are found in the temporal distribution of temperature.
- Possible reasons for these biases are investigated using radiosondes, surface and TOA radiation measurements and wind speed tower measurements.

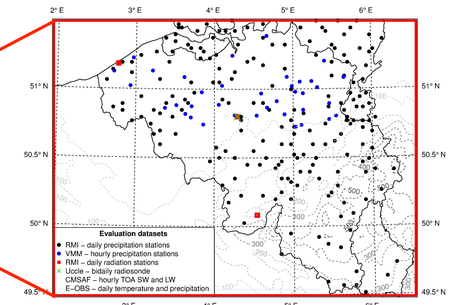
2. Model configuration and evaluation dataset

- COSMO4.8clm11
- CPS -> 0.025° only
- Simulation period 2000-2010
- ERA-Interim driven

Model domain – Triple nesting



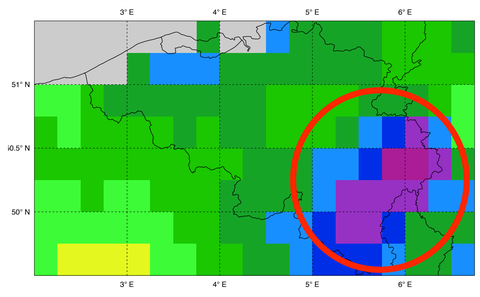
Evaluation domain and datasets



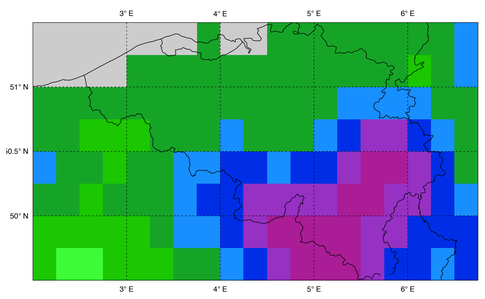
3. Performance of CPS compared to non-CPS simulations

A. Improvement related to enhanced description of orography

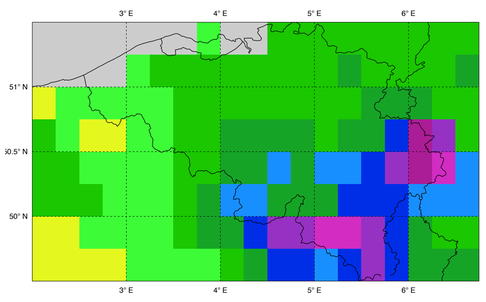
E-OBS – Orographically induced precipitation



Too wide-spread precipitation at 0.22°

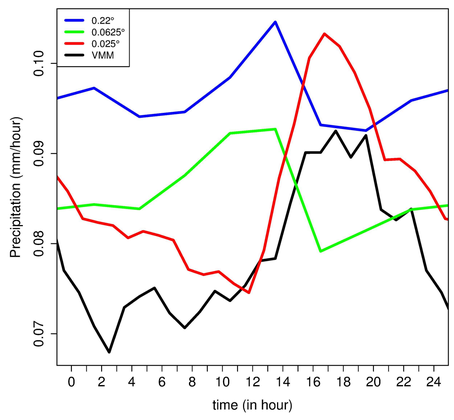


More realistic spatial pattern at 0.025°

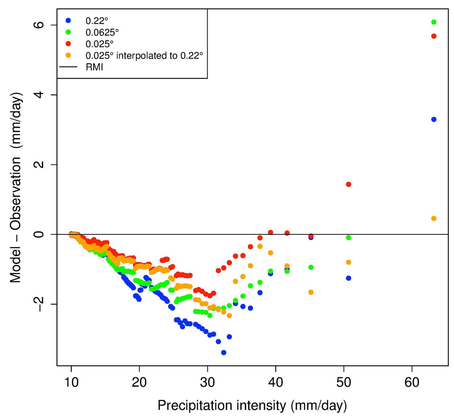


B. Improvements related to dynamically resolved convection

Improved precipitation daily cycle

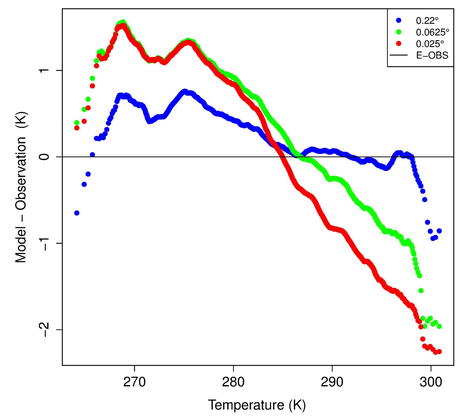


Improved precipitation extremes

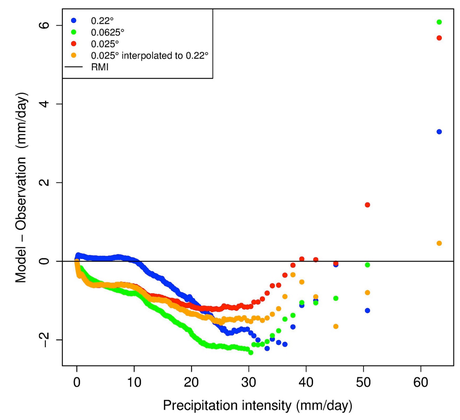


C. Deteriorations

Too warm summer days and too cold winter days



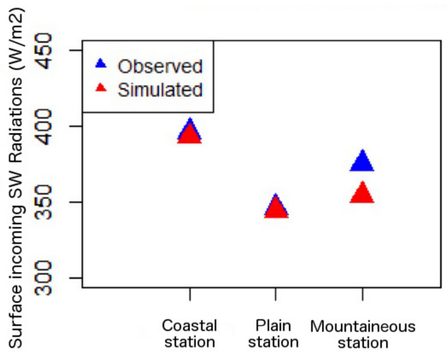
Underestimation of light precipitation (e.g. <1mm)



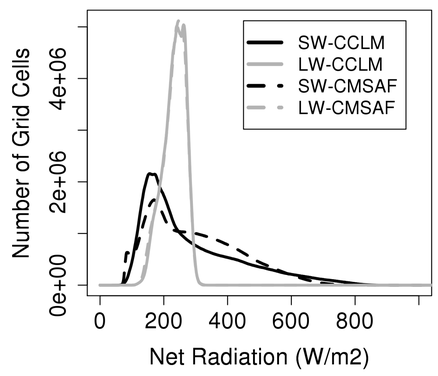
4. Plausible cause for temperature and light precipitation biases

A. Too few and too reflective clouds

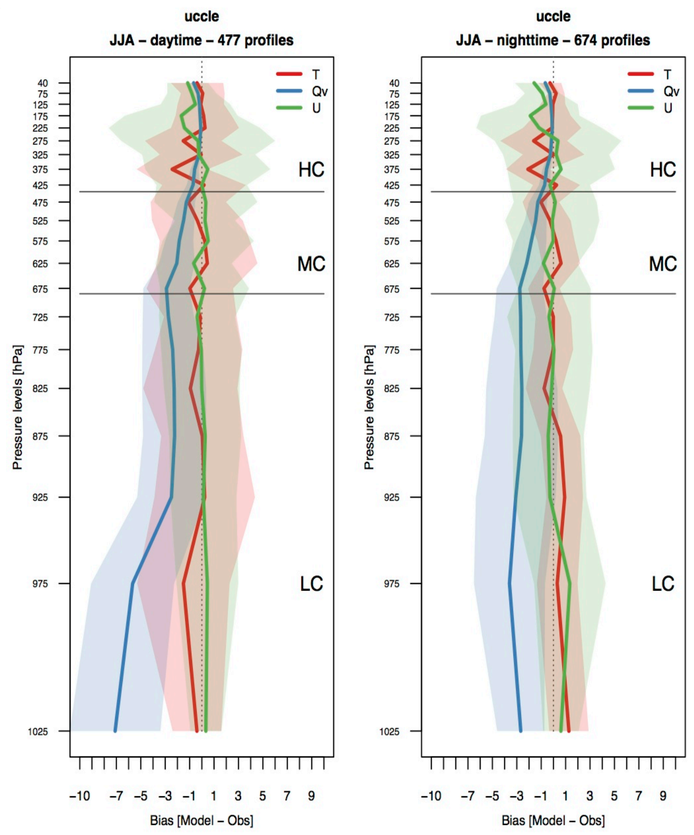
Too small shortwave radiation at the surface in complex terrain



Too many clear days and too reflective clouds



B. Deficit of low and midlevel humidity, notably close to the surface during the day.



5. Conclusions and outlook

- Findings of previous CPS studies (e.g. improved representation of spatial pattern and daily cycle of precipitation - 3A,B) are confirmed on decadal time-scales.
- However, the light precipitation is seriously underestimated and temperatures are too low in Winter and too high in Summer.
- First investigations show that both clouds and humidity are underestimated. Cloud optical thickness and cloud top pressure will be evaluated to confirm this bias.
- Large underestimation of humidity in the lowest layer suggests bias in the lowest boundary layer. The following investigations are planned:
  - Wind speed
  - 150-meter mast profiles
  - Soil moisture

For further information please contact Erwan Brisson: brisson@iau.uni-frankfurt.de